

Mathematics Toolkit: Grade 4 Objective 5.B.1.a

Standard 5.0 Knowledge of Probability

Topic B. Theoretical Probability

Indicator 1. Determine the probability of one simple event comprised of equally likely outcomes

Objective a. Express the probability as a fraction

Assessment Limits:

Use a sample space of no more than 6 outcomes

Table of Contents

Objective 5.B.1.a Tools

- Clarification
- Higher Order Thinking Skill
- Sample Item #1 - Selected Response (SR)
- Sample Item #2 - Selected Response (SR)
- Sample Item #3 - Selected Response (SR)
- Sample Item #4 - Brief Constructed Response (BCR)

Scoring Rubric

- Rubric - Brief Constructed Response

Clarification

Mathematics Grade 4 Objective 5.B.1.a Assessment Limit 1

Probability is the chance or likelihood of an event occurring. Theoretical probability describes the chance of an event occurring based on possible outcomes. For example, when flipping a coin, you could get heads or you could get tails. So the outcomes are heads or tails. An event is a specific set of outcomes, such as tails. A favorable outcome is one in the set of outcomes for which we want to find the probability.

- When flipping a coin there is a $\frac{1}{2}$ chance that you will get heads on a flip. Or this can be thought of as 1 out of 2 chances.

$$P = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}} = \frac{1}{2}$$

- When rolling a number cube, the possible outcomes are 1, 2, 3, 4, 5, and 6. There are 6 possible outcomes. Rolling an even number is an event. Rolling a 2, or a 4, or a 6 is each a favorable outcome. What is the probability of rolling an even number? Since there are three favorable outcomes that could occur (2, 4, 6), and they are equally likely, the probability is $\frac{3}{6}$.
- A bag contains 6 marbles (2 red, 4 blue).

What is the probability of picking a red marble? $\frac{2}{6}$

What is the probability of picking a blue marble? $\frac{4}{6}$

What is the probability of picking a yellow marble? $\frac{0}{6}$

Note: Even though there are only 2 colors, there are six marbles. Therefore there are 6 outcomes.

Classroom Example 1

Connections within the content:

A bag contains 6 marbles. 2 are red and 4 are blue.

Which of the numbers below is the probability of picking a red marble?

- A. $\frac{1}{2}$
- B. $\frac{1}{4}$
- C. $\frac{1}{3}$
- D. $\frac{2}{3}$

Answer: C

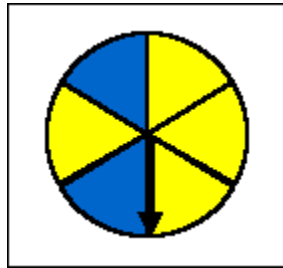
Although the content of the item is essentially probability, the answer choices require that the student be able to simplify fractions. Simplifying fractions is a skill within the content of number. When appropriate, connect number concepts to concepts within the other content strands to show how number concepts and operations need not be taught in isolation.

Higher Order Thinking Skills

Mathematics Grade 4 Objective 5.B.1.a Assessment Limit 1

Question

Look at the spinner.



Level 1: Knowledge/Comprehension

- What is the probability of the arrow landing on yellow?
- What is the probability of the arrow landing on blue?

Level 2: Application/Analysis

- Which has a greater probability of occurring, the arrow landing on yellow or landing on blue? Explain your answer.
- Harry and Linda are playing a game with the spinner. When the arrow lands on yellow, Harry gets a point. When the arrow lands on blue, Linda gets a point. Predict how many points Harry will have after 6 spins. Predict how many points Linda will have after 6 spins. Use what you know about probability and fractions to explain your answer.

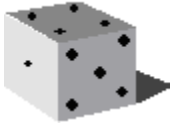
Level 3: Synthesis/Evaluation

- What is the probability of landing on yellow? Explain why your answer is correct. Use what you know about probability in your explanation.
- Harry and Linda are playing a game with the spinner. When the arrow lands on yellow, Harry gets a point. When the arrow lands on blue, Linda gets a point. Predict how many points Harry will have after 12 spins. Predict how many points Linda will have after 12 spins.
After 12 spins who has more points? What could you do to the spinner to give each person an equal chance of winning?
What could you do to the game rules to give each person an equal chance of winning?

Sample Item #1 - Selected Response (SR) Item

Mathematics Grade 4 Objective 5.B.1.a

You roll a six-sided number cube with 1, 2, 3, 4, 5, or 6 dots on a side.



What is the probability of rolling the side with one dot?

- A. $\frac{1}{6}$
- B. $\frac{1}{3}$
- C. $\frac{1}{2}$
- D. 1

Correct Answer:

A

Sample Item #2 - Selected Response (SR) Item

Mathematics Grade 4 Objective 5.B.1.a

Todd and Harry are playing a game using a number cube with the numbers 1 to 6. Todd needs to roll a 4 to win. What is the probability that Todd rolls a 4 on his next roll?

- A. $\frac{1}{3}$
- B. $\frac{1}{4}$
- C. $\frac{1}{5}$
- D. $\frac{1}{6}$

Correct Answer:

D

Sample Item #3 - Selected Response (SR) Item

Mathematics Grade 4 Objective 5.B.1.a

You have flipped a penny 10 times and it has landed on heads every time. When you flip the penny the next time, what are your chances of the penny landing on heads?

- A. $\frac{1}{2}$
- B. $\frac{1}{10}$
- C. $\frac{2}{1}$
- D. $\frac{10}{1}$

Correct Answer:

A

Sample Item #4 - Brief Constructed Response (BCR) Item

Mathematics Grade 4 Objective 5.B.1.a

Mary has 6 jelly beans in a bag. She has 3 red, 1 green, 1 black, and 1 yellow. She chooses a jelly bean without looking.

Step A

What is the probability that Mary picks a red jelly bean?

Step B

Explain why your answer is correct.

Use what you know about probability in your explanation.

Use words and/or numbers in your explanation.

Correct Answer:

Step A

$\frac{3}{6}$ or any other equivalent.

Answer Annotation

Sample correct response: There are 6 jelly beans altogether. 3 are red. The probability of picking a red jelly bean is 3 out of 6 or $\frac{3}{6}$.

Rubric - Brief Constructed Response (BCR)

Score 2

The response demonstrates a complete understanding and analysis of a problem.

- Application of a reasonable strategy in the context of the problem is indicated.
- Explanation¹ of and/or justification² for the mathematical process(es) used to solve a problem is clear, developed, and logical.
- Connections and/or extensions made within mathematics or outside of mathematics are clear.
- Supportive information and/or numbers are provided as appropriate.³

Score 1

The response demonstrates a minimal understanding and analysis of a problem.

- Partial application of a strategy in the context of the problem is indicated.
- Explanation¹ of and/or justification² for the mathematical process(es) used to solve a problem is partially developed, logically flawed, or missing.
- Connections and/or extensions made within mathematics or outside of mathematics are partial or overly general, or flawed.
- Supportive information and/or numbers may or may not be provided as appropriate.³

Score 0

The response is completely incorrect, irrelevant to the problem, or missing.⁴

Notes:

- ¹ Explanation refers to students' ability to communicate how they arrived at the solution for an item using the language of mathematics.
- ² Justification refers to students' ability to support the reasoning used to solve a problem, or to demonstrate why the solution is correct using mathematical concepts and principles.
- ³ Students need to complete rubric criteria for explanation, justification, connections and/or extensions as cued for in a given problem.
- ⁴ Merely an exact copy or paraphrase of the problem will receive a score of "0".

Rubric Document Date: August 2003